



6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 82

[EPA-HQ-OAR-2019-0698; FRL-10009-66-OAR]

RIN 2060-AU81

Protection of Stratospheric Ozone: Listing of Substitutes under the Significant New Alternatives Policy Program

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of proposed rulemaking.

SUMMARY: Pursuant to the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy program, this action proposes to list certain substances in the refrigeration and air conditioning sector and the foam blowing sector. For the retail food refrigeration—medium-temperature stand-alone units (new) end-use, EPA is proposing to list substitutes as acceptable subject to narrowed use limits. For the residential and light commercial air conditioning and heat pumps (new) end-use, EPA is proposing to list substitutes as acceptable subject to use conditions. For the foam blowing sector, extruded polystyrene: boardstock and billet end-use, EPA is proposing to list substitutes as acceptable. This action also proposes to remove an acceptable subject to use conditions listing for the fire suppression sector because EPA more recently listed the substitute as acceptable with no use restrictions.

DATES: Comments must be received on or before **[INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. Any party requesting a public hearing must notify the contact listed below under **FOR FURTHER INFORMATION CONTACT** by 5 p.m. Eastern Daylight Time on **[INSERT DATE 5 DAYS AFTER DATE OF**

PUBLICATION IN THE FEDERAL REGISTER]. If a virtual hearing is held, it will take place on or before **[INSERT DATE 15 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]** and further information will be provided on EPA's Stratospheric Ozone website at www.epa.gov/ozone/snap.

ADDRESSES: You may send comments, identified by docket identification (ID) number EPA-HQ-OAR-2019-0698, to the *Federal eRulemaking Portal*: <http://www.regulations.gov>. Follow the online instructions for submitting comments. Once submitted, comments cannot be edited or withdrawn. EPA may publish any comment received to its public docket. Do not submit electronically any information you consider to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Multimedia submissions (audio, video, etc.) must be accompanied by a written comment. The written comment is considered the official comment and should include discussion of all points you wish to make. EPA will generally not consider comments or comment contents located outside of the primary submission (*i.e.*, on the web, cloud, or other file sharing system). For additional submission methods, EPA's full public comment policy, information about CBI or multimedia submissions, and general guidance on making effective comments, please visit <https://www.epa.gov/dockets/commenting-epa-dockets>. Out of an abundance of caution for members of the public and our staff, the EPA Docket Center and Reading Room was closed to public visitors on March 31, 2020, to reduce the risk of transmitting COVID-19. Our Docket Center staff will continue to provide remote customer service via email, phone, and webform. We encourage the public to submit comments via <https://www.regulations.gov> or email, as there is a temporary suspension of mail delivery to EPA, and no hand deliveries are currently accepted. For further information on EPA Docket Center services and the current status, please visit us online at <https://www.epa.gov/dockets>.

FOR FURTHER INFORMATION CONTACT: Christina Thompson, Stratospheric Protection Division, Office of Atmospheric Programs (Mail Code 6205T), Environmental Protection Agency, 1200 Pennsylvania Ave. NW, Washington, DC 20460; telephone number: 202-564-0983; email address: *thompson.christina@epa.gov*. Notices and rulemakings under EPA's Significant New Alternatives Policy program are available on EPA's Stratospheric Ozone website at <https://www.epa.gov/snap/snap-regulations>.

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IV. References

I. General information

A. Executive summary and background

This action proposes to list new alternatives for the refrigeration and air conditioning sector and for the foam blowing sector and to change an existing listing for the fire suppression sector. Specifically, EPA is proposing to:

- List R-448A, R-449A and R-449B as acceptable, subject to narrowed use limits, for use in retail food refrigeration—medium-temperature stand-alone units for new

equipment;

- List R-452B, R-454A, R-454B, R-454C and R-457A as acceptable, subject to use conditions, for use in residential and light commercial air conditioning (AC) and heat pumps for new equipment and R-32 as acceptable, subject to use conditions, for use in residential and light commercial AC and heat pumps—equipment other than self-contained room air conditioners, for new equipment;
- List blends of 40 to 52 percent hydrofluorocarbon (HFC)-134a and the remainder hydrofluoroolefin (HFO)-1234ze(E); blends of 40 to 52 percent HFC-134a with 40 to 60 percent HFO-1234ze(E) and 10 to 20 percent each water and carbon dioxide (CO₂); and blends with maximum of 51 percent HFC-134a, 17 to 41 percent HFC-152a, up to 20 percent CO₂ and one to 13 percent water as acceptable for use in extruded polystyrene: boardstock and billet (XPS); and
- Remove Powdered Aerosol E from the list of fire suppression substitutes acceptable subject to use conditions in total flooding applications.

EPA is proposing these listings after its evaluation of human health and environmental information on various substitutes submitted to the Significant New Alternatives Policy (SNAP) program. This action provides additional flexibility for industry by providing new options in specific uses and situations.

In this proposed rule, EPA refers to listings made in a final rule issued July 20, 2015, at 80 FR 42870 (“2015 Rule”). The 2015 Rule, among other things, changed the listings for certain HFCs and blends from acceptable to unacceptable in various end-uses in the aerosols, refrigeration and air conditioning, and foam blowing sectors. After a challenge to the 2015 Rule, the United States Court of Appeals for the District of Columbia Circuit (“the court”) issued a

partial vacatur of the 2015 Rule “to the extent it requires manufacturers to replace HFCs with a substitute substance”¹ and remanded the rule to the Agency for further proceedings.² The court also upheld EPA’s listing changes as being reasonable and not “arbitrary and capricious.”³ This proposed rule is not EPA’s response to the court’s decision. EPA is developing a future proposed rule to respond to the court’s decision.

SNAP program background

The SNAP program implements section 612 of the Clean Air Act (CAA). Several major provisions of section 612 are:

1. Rulemaking

Section 612(c) requires EPA to promulgate rules making it unlawful to replace any class I (chlorofluorocarbon (CFC), halon, carbon tetrachloride, methyl chloroform, methyl bromide, hydrobromofluorocarbon, and chlorobromomethane) or class II (hydrochlorofluorocarbon (HCFC)) ozone-depleting substances (ODS) with any substitute that the Administrator determines may present adverse effects to human health or the environment where the Administrator has identified an alternative that (1) reduces the overall risk to human health and the environment and (2) is currently or potentially available.

2. Listing of Unacceptable/Acceptable Substitutes

Section 612(c) requires EPA to publish a list of the substitutes that it finds to be unacceptable for specific uses and to publish a corresponding list of acceptable substitutes for specific uses.

¹ *Mexichem Fluor, Inc. v. EPA*, 866 F.3d 451, 462 (D.C. Cir. 2017).

² Later, the court issued a similar decision on portions of a similar final rule issued December 1, 2016 at 81 FR 86778 (“2016 Rule”). *See Mexichem Fluor, Inc. v. EPA*, Judgment, Case No. 17-1024 (D.C. Cir., April 5, 2019), 760 Fed. Appx. 6 (Mem). That rule is not relevant for this action.

³ *Mexichem Fluor*, 866 F.3d at 462-63.

3. Petition Process

Section 612(d) grants the right to any person to petition EPA to add a substance to, or delete a substance from, the lists published in accordance with section 612(c).

4. 90-Day Notification

Section 612(e) directs EPA to require any person who produces a chemical substitute for a class I substance to notify the Agency not less than 90 days before a new or existing chemical is introduced into interstate commerce for significant new use as a substitute for a class I substance. The producer must also provide the Agency with the producer's unpublished health and safety studies on such substitutes.

The regulations for the SNAP program are promulgated at 40 CFR part 82, subpart G, and the Agency's process for reviewing SNAP submissions is described in regulations at 40 CFR 82.180. Under these rules, the Agency has identified five types of listing decisions: Acceptable; acceptable subject to use conditions; acceptable subject to narrowed use limits; unacceptable; and pending (40 CFR 82.180(b)). Use conditions and narrowed use limits are both considered "use restrictions," as described below. Substitutes that are deemed acceptable with no use restrictions (no use conditions or narrowed use limits) can be used for all applications within the relevant end-uses in the sector. After reviewing a substitute, the Agency may determine that a substitute is acceptable only if certain conditions in the way that the substitute is used are met to minimize risks to human health and the environment. EPA describes such substitutes as "acceptable subject to use conditions." (40 CFR 82.180(b)(2)). For some substitutes, the Agency may permit a narrowed range of use within an end-use or sector. For example, the Agency may limit the use of a substitute to certain end-uses or specific applications within an industry sector. EPA describes these substitutes as "acceptable subject to narrowed use limits." Under the

narrowed use limit, users intending to adopt these substitutes “must ascertain that other alternatives are not technically feasible.” (40 CFR 82.180(b)(3)).

In making decisions regarding whether a substitute is acceptable or unacceptable, and whether substitutes present risks that are lower than or comparable to risks from other substitutes that are currently or potentially available in the end-uses under consideration, EPA examines the criteria in 40 CFR 82.180(a)(7): (i) atmospheric effects and related health and environmental impacts; (ii) general population risks from ambient exposure to compounds with direct toxicity and to increased ground-level ozone; (iii) ecosystem risks; (iv) occupational risks; (v) consumer risks; (vi) flammability; and (vii) cost and availability of the substitute.

For additional information on the SNAP program, visit the SNAP portion of EPA’s Ozone Layer Protection website at www.epa.gov/snap. Copies of the full lists of acceptable substitutes for ODS in all industrial sectors are available at www.epa.gov/snap/substitutes-sector. For more information on the Agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the initial SNAP rulemaking published March 18, 1994 (59 FR 13044), codified at 40 CFR part 82, subpart G. SNAP decisions and the appropriate *Federal Register* citations are found at: www.epa.gov/snap/snap-regulations. Substitutes listed as unacceptable; acceptable, subject to narrowed use limits; or acceptable, subject to use conditions, are also listed in the appendices to 40 CFR part 82, subpart G.

B. Does this action apply to me?

The following list identifies regulated entities that may be affected by this proposed rule and their respective North American Industrial Classification System (NAICS) codes:

- All Other Basic Organic Chemical Manufacturing (NAICS 325199)
- Polystyrene Foam Product Manufacturing (NAICS 326140)

- Urethane and Other Foam Product (except Polystyrene) Manufacturing (NAICS 326150)
- Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing (NAICS 333415)
- Refrigeration Equipment and Supplies Merchant Wholesalers (NAICS 423740)
- Supermarkets and Other Grocery (except Convenience) Stores (NAICS 44511 & 445110)
- Convenience Stores (NAICS 445120)
- Limited-Service Restaurants (NAICS 722513)
- Cafeterias, Grill Buffets, and Buffets (NAICS 722514)
- Snack and Nonalcoholic Beverage Bars (NAICS 722515)
- Fire Protection (NAICS 922160)

C. What acronyms and abbreviations are used in the preamble?

Below is a list of acronyms and abbreviations used in the preamble of this document:

AC—Air Conditioning

ADA—Americans with Disabilities Act

AEL—Acceptable Exposure Limit

AHRI—Air-Conditioning, Heating, and Refrigeration Institute

ANSI—American National Standards Institute

ASHRAE—American Society of Heating, Refrigerating and Air-Conditioning Engineers

ASTM—American Society for Testing and Materials

CAA—Clean Air Act

CAS Reg. No.—Chemical Abstracts Service Registry Identification Number

CBI—Confidential Business Information

CCAC—Climate and Clean Air Coalition

CFC—Chlorofluorocarbon

CFR—Code of Federal Regulations

CO₂—Carbon Dioxide

DOE—United States Department of Energy

EPA—United States Environmental Protection Agency

FR—Federal Register

GSHP—Ground-Source Heat Pump

GWP—Global Warming Potential

HCFC—Hydrochlorofluorocarbon

HFC—Hydrofluorocarbon

HFO—Hydrofluoroolefin

HP—Heat Pump

ICF—ICF International, Inc.

IPCC—Intergovernmental Panel on Climate Change

LFL—Lower Flammability Limit

MBtu—Million British thermal units

NAAQS—National Ambient Air Quality Standards

NAICS—North American Industrial Classification System

NFPA—National Fire Protection Association

NIOSH—National Institute for Occupational Safety and Health

NPRM—Notice of Proposed Rulemaking

ODP—Ozone Depletion Potential

OMB—United States Office of Management and Budget

OSHA—United States Occupational Safety and Health Administration

PEL—Permissible Exposure Limit

ppm—Parts Per Million

PRA—Paperwork Reduction Act

PTAC—Packaged Terminal Air Conditioner

PTHP—Packaged Terminal Heat Pump

RFA—Regulatory Flexibility Act

SDS—Safety Data Sheet

SIP—State Implementation Plan

SNAP—Significant New Alternatives Policy

STEL—Short-term Exposure Limit

TSCA—Toxic Substances Control Act

TWA—Time Weighted Average

UL—Underwriters Laboratories Inc

UMRA—Unfunded Mandates Reform Act

VOC—Volatile Organic Compounds

VRF—Variable Refrigerant Flow

WEEL—Workplace Environmental Exposure Limit

WSHP—Water-Source Heat Pump

XPS—Extruded Polystyrene: Boardstock and Billet

II. What is EPA proposing in this action?

A. Retail food refrigeration—Proposed listing of R-448A, R-449A and R-449B as acceptable, subject to narrowed use limits, for retail food refrigeration—medium-temperature stand-alone units (new)

EPA is proposing to list R-448A, R-449A, and R-449B as acceptable, subject to narrowed use limits, in new equipment only for new medium-temperature stand-alone units in retail food refrigeration (hereafter, “new medium-temperature stand-alone units”).⁴

Under the narrowed use limit, users⁵ intending to adopt these refrigerants “must ascertain that other alternatives are not technically feasible.” (40 CFR 82.180(b)(3)). In addition, the end users “must document the results of their evaluation and retain the results on file for the purpose of demonstrating compliance. This documentation shall include descriptions of substitutes examined and rejected, processes or products in which the substitute is needed, reason for rejection of other alternatives, e.g., performance, technical or safety standards, and the anticipated date other substitutes will be available and projected time for switching to other available substitutes.” (40 CFR 82.180(b)(3)).

1. Background on retail food refrigeration—medium-temperature stand-alone units

Retail food refrigeration is characterized by storing and displaying, generally for sale, food and beverages at different temperatures for different products (e.g., chilled and frozen food). Stand-alone units in retail food refrigeration (hereafter, “stand-alone units”) consist of refrigerators, freezers, and reach-in coolers (either open or with doors) where all refrigeration

⁴ EPA previously divided the retail food refrigeration end-use into separate categories, including stand-alone equipment (76 FR 78832, December 20, 2011). The Agency further subdivided stand-alone equipment to distinguish between medium-temperature equipment, which maintains products above 32°F (0°C), and low-temperature equipment, which maintains products at or below 32°F (0°C) (80 FR 42870, July 20, 2015).

⁵ Note that the definition of “use” includes “but [is] not limited to use in a manufacturing process or product, in consumption by the end-user, or in intermediate uses, such as formulation or packaging for other subsequent uses”; hence, this definition includes the manufacture of a product pre-charged with or intended for a particular refrigerant. (40 CFR 82.172).

components are integrated and, for the smallest types, the refrigeration circuit is entirely brazed or welded. These systems are charged with refrigerant at the factory and typically require only an electricity supply to begin operation.

For purposes of the SNAP program, medium-temperature stand-alone units maintain a temperature above 32°F (0°C). Most are typically designed to maintain products at temperatures roughly between 32°F (0°C) and 41°F (5°C). EPA treats this as a separate end-use category from low-temperature stand-alone units designed to maintain products at temperatures roughly between -40°F (-40°C) and 32°F (0°C) (i.e., freezers). In addition, the Agency considers equipment designed to make or process cold food and beverages that are dispensed via a nozzle, including soft-serve ice cream machines, “slushy” iced beverage dispensers, and soft-drink dispensers, to be a separate end-use category from stand-alone units (refrigerated food processing and dispensing equipment). EPA has listed different substitutes as acceptable in these end-use categories based on the Agency’s understanding of the availability of substitutes able to meet the technical and regulatory requirements for each equipment type and temperature range. For example, EPA listed R-448A, R-449A and R-449B as acceptable in low-temperature stand-alone units and in refrigerated food processing and dispensing equipment (80 FR 42053, July 16, 2015; 81 FR 70029, October 11, 2016). Whereas EPA listed R-290 (propane) as acceptable subject to use conditions in stand-alone units, both medium-temperature and low-temperature (76 FR 78832, December 20, 2011), the Agency has not listed it for refrigerated food processing and dispensing equipment. Acceptable substitutes for medium-temperature stand-alone units include ammonia vapor compression with secondary loop, R-744 (carbon dioxide or CO₂), R-290, R-441A, R-450A, R-513A, and R-600a (isobutane), among others.

In the 2015 Rule, EPA changed the listing of 31 refrigerants⁶ from acceptable to unacceptable for medium temperature stand-alone units. At that time, EPA indicated that it believed that other alternatives that posed lower risk were available for this end use. As part of a petition from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI),⁷ described in section 3 below, EPA received information indicating that manufacturers were unable to design certain types of medium-temperature stand-alone equipment with the available acceptable alternatives. AHRI explained that due to the thermodynamic properties of the available alternatives, equipment would need to be redesigned using larger components. Because these components are located at the bottom of the unit, the larger size would lead to designs where the refrigerated product would be placed too high to comply with countertop height requirements of the Americans with Disabilities Act (ADA), or would be too wide such that it protruded into aisles and likewise conflicted with ADA requirements.

2. What are R-448A, R-449A and R-449B and how do they compare to other refrigerants in the same end-use?

R-448A, marketed under the trade name Solstice[®] N-40, is a weighted blend of 26 percent HFC-32, which is also known as difluoromethane (Chemical Abstracts Service Registry Number [CAS Reg. No.] 75-10-5); 26 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 21 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); 20 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1); and seven percent HFO-

⁶ Specifically, FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03.

⁷ AHRI, 2017. Petition Requesting EPA SNAP Approval of R-448A/449A/449B for Medium Temperature, Stand-Alone Retail Food Refrigeration Equipment. Submitted March 20, 2017.

1234ze(E), which is also known as trans-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9). R-449A, marketed under the trade name Opteon[®] XP 40, is a weighted blend of 24.3 percent HFC-32, 24.7 percent HFC-125, 25.7 percent HFC-134a, and 25.3 percent HFO-1234yf. R-449B, marketed under the trade name Forane[®] 449B, is a weighted blend of 25.2 percent HFC-32, 24.3 percent HFC-125, 27.3 percent HFC-134a, and 23.2 percent HFO-1234yf.

EPA previously listed R-448A, R-449A, and R-449B as acceptable refrigerants in a number of other refrigeration and air conditioning end-uses, including other retail food refrigeration end-use categories (e.g., 80 FR 42053, July 16, 2015; 81 FR 70029, October 11, 2016; 82 FR 33809, July 21, 2017; 83 FR 50026, October 4, 2018; 84 FR 64765, November 25, 2019).

Redacted submissions and supporting documentation for R-448A, R-449A, and R-449B are provided in the docket for this proposed rule (EPA-HQ-OAR-2019-0698) at <https://www.regulations.gov>. EPA performed an assessment to examine the health and environmental risks of each of these substitutes. These assessments are available in the docket for this proposed rule.^{8 9 10}

Environmental information: R-448A, R-449A, and R-449B have an ozone depletion potential (ODP) of zero.¹¹ Their components, HFC-32, HFC-125, HFC-134a, HFO-1234yf, and in the case of R-448A, HFO-1234ze(E), have global warming potentials (GWPs) of 675; 3,500;

⁸ ICF, 2020a. Risk Screen on Substitutes in Retail Food Refrigeration (Medium-temperature Stand-alone Units) (New Equipment); Substitute: R-448A.

⁹ ICF, 2020b. Risk Screen on Substitutes in Retail Food Refrigeration (Medium-temperature Stand-alone Units) (New Equipment); Substitute: R-449A.

¹⁰ ICF, 2020c. Risk Screen on Substitutes in Retail Food Refrigeration (Medium-temperature Stand-alone Units) (New Equipment); Substitute: R-449B.

¹¹ If a compound contains no chlorine, bromine, or iodine, or if it is a solid under conditions of use, its ODP is generally considered to be zero. Unless otherwise stated, all non-zero ODPs in this document are from EPA's regulations at appendix A to subpart A of 40 CFR part 82.

1,430;¹² one to four;^{13,14} and one to six;¹⁵ respectively. HFC-32 (CAS Reg. No. 75-10-5), HFC-125 (CAS Reg. No. 354-33-6), HFC-134a (CAS Reg. No. 811-97-2), HFO-1234yf (CAS Reg. No. 754-12-1) and HFO-1234ze(E) (CAS Reg. No. 29118-24-9)—the components of R-448A, R-449A, and R-449B—are excluded from the definition of volatile organic compounds (VOC) under CAA regulations (see 40 CFR 51.100(s)) addressing the development of state implementation plans (SIPs) to attain and maintain the national ambient air quality standards (NAAQS). Knowingly venting or otherwise knowingly releasing or disposing of these refrigerant blends in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration is prohibited as provided in section 608(c)(2) of the CAA and EPA's regulations at 40 CFR 82.154(a)(1).

Flammability information: R-448A, R-449A, and R-449B as formulated, and even considering the worst-case fractionation for flammability, are not flammable.

Toxicity and exposure data: Potential health effects of exposure to these substitutes include drowsiness or dizziness. The substitutes may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitutes may cause irregular heartbeat. The substitutes could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

¹² Unless otherwise specified, GWP values are from IPCC (2007) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). Cambridge University Press. Cambridge, United Kingdom 996 pp.

¹³ Nielsen et al., 2007. Nielsen, O.J., Javadi, M.S., Sulbaek Andersen, M.P., Hurley, M.D., Wallington, T.J., Singh, R. 2007. Atmospheric chemistry of CF₃CF=CH₂: Kinetics and mechanisms of gas-phase reactions with Cl atoms, OH radicals, and O₃. *Chemical Physics Letters* 439, 18–22. Available online at http://www.cogci.dk/network/OJN_174_CF3CF=CH2.pdf.

¹⁴ Hodnebrog Ø. et al., 2013. Hodnebrog Ø., Etminan, M., Fuglestad, J.S., Marston, G., Myhre, G., Nielsen, C.J., Shine, K.P., Wallington, T.J.: Global Warming Potentials and Radiative Efficiencies of Halocarbons and Related Compounds: A Comprehensive Review, *Reviews of Geophysics*, 51, 300–378, doi:10.1002/rog.20013, 2013.

¹⁵ Hodnebrog Ø. et al., 2013 and Javadi et al., 2008. M.S. Javadi, R. Søndergaard, O.J. Nielsen, M.D. Hurley, and T.J. Wallington, 2008. Atmospheric chemistry of trans-CF₃CH=CHF: products and mechanisms of hydroxyl radical and chlorine atom-initiated oxidation. *Atmospheric Chemistry and Physics Discussions* 8, 1069–1088, 2008.

The American Industrial Hygiene Association (AIHA) has established workplace environmental exposure limits (WEELs) of 1,000 parts per million (ppm) as an eight hour time-weighted average (8-hr TWA) for HFC-32, HFC-125, and HFC-134a, and 500 ppm for HFO-1234yf, the components of R-448A, R-449A, and R-449B; and 800 ppm for HFO-1234ze(E), also a component of R-448A. The manufacturer of R-448A recommends an acceptable exposure limit (AEL) of 890 ppm on an 8-hr TWA for the blend. The manufacturer of R-449A recommends an AEL of 830 ppm on an 8-hr TWA for the blend. The manufacturer of R-449B recommends an AEL of 865 ppm on an 8-hr TWA for the blend. EPA anticipates that users will be able to meet the AIHA WEELs and manufacturers' AELs and address potential health risks by following requirements and recommendations in the manufacturers' safety data sheets (SDS), in American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in this end-use: R-448A, R-449A, and R-449B have ODPs of zero, comparable to or lower than other acceptable substitutes in this end-use, with ODPs ranging from zero to 0.098.

R-448A's GWP of 1,390, R-449A's GWP of 1,400, and R-449B's GWP of 1,410 are higher than those of other acceptable substitutes for retail food refrigeration—medium-temperature stand-alone units (new), including ammonia absorption, R-744, R-450A, and R-513A with GWPs ranging from zero to 630.

Information regarding the flammability and toxicity of other available alternatives are provided in the listing decisions previously made (see <https://www.epa.gov/snap/substitutes-stand-alone-equipment>). Flammability and toxicity risks are comparable to or lower than

flammability and toxicity risks of other available substitutes in the same end-use. Toxicity risks can be minimized by use consistent with ASHRAE 15 and other industry standards, recommendations in the manufacturers' safety data sheet (SDS), and other safety precautions common in the refrigeration and air conditioning industry.

Although R-448A, R-449A, and R-449B present a higher overall risk to human health and the environment than other acceptable alternatives in this end-use category based on significantly higher GWPs than other available alternatives, with GWPs ranging from zero (ammonia in a secondary loop) to 630 (R-513A), as provided below, information suggests that other alternatives may not be available for certain uses and users of medium-temperature stand-alone equipment. Thus, EPA is proposing to list these substitutes as acceptable subject to narrowed use limits in this end-use. The manufacturers of new medium-temperature stand-alone equipment would need to demonstrate that the other alternatives are not technically feasible. They must document the results of their evaluation that showed the other alternatives to be not technically feasible and maintain that documentation in their files. This documentation, which does not need to be submitted to EPA unless requested to demonstrate compliance, "shall include descriptions of substitutes examined and rejected, processes or products in which the substitute is needed, reason for rejection of other alternatives, e.g., performance, technical or safety standards, and the anticipated date other substitutes will be available and projected time for switching to other available substitutes." (40 CFR 82.180(b)(3)).

3. Summary of AHRI petition

AHRI petitioned EPA under CAA section 612(d) to add R-448A, R-449A, and R-449B to the list of acceptable substitutes for new and retrofit medium-temperature stand-alone units. See 40 CFR 82.184 for further information regarding petitions under the SNAP program. EPA

and AHRI have exchanged information related to this petition between March 2017 and November 2018. Although we are not formally responding to the AHRI petition or deeming it “complete” in this proposed rulemaking, some of the information received as part of this petition is relevant to the proposed listing, as discussed below, and EPA’s action in this rulemaking may be considered responsive to certain aspects of this petition, given that EPA is proposing to list R-448A, R-449A, and R-449B as acceptable, subject to narrowed use limits, in new medium-temperature stand-alone units.

In its petition, AHRI raised claims that refrigerants currently listed as acceptable are not available for use in all types of equipment within this end-use category. AHRI’s petition addressed five key points. First, AHRI claims, based on their members’ experience in the industry, that the use of these three refrigerants compared to the acceptable alternatives is simpler based on their members’ experience and knowledge and on the equipment efficiency and component supply borne out of EPA’s listing of these refrigerants in low-temperature stand-alone units and other end-use categories. However, EPA notes that it does not consider the simplicity of designing equipment to be part of the SNAP criteria. In fact, manufacturer literature^{16 17 18 19 20} shows that there are some medium-temperature stand-alone units available with the acceptable alternatives, indicating that at least for some products and some manufacturers, any complexity issues with designing such equipment have been resolved.

Second, AHRI claims that the available alternatives are not able to meet the U.S.

¹⁶ CCAC, 2012. Technology Forum on Climate Friendly Alternatives in Commercial Refrigeration. Meeting Summary. 8 December 2012.

¹⁷ Coca-Cola, 2014. Coca-Cola Installs 1 Millionth HFC-Free Cooler Globally, Preventing 5.25MM Metric Tons of CO₂, January 22, 2014.

¹⁸ Shecco, 2013a. HCs Gaining Market Prominence in US—View from the NAFEM Show—Part 1, February 18, 2013.

¹⁹ Shecco, 2013b. HCs Gaining Market Prominence in US—View from the NAFEM Show—Part 2, February 25, 2013.

²⁰ Shecco, 2015. New Regulations Inspire Hydrocarbon Displays at U.S. NAFEM Show, February 24, 2015.

Department of Energy (DOE) Energy Conservation Standards for Commercial Refrigeration Equipment (79 FR 17725, March 28, 2014), which have a compliance date of March 27, 2017, for some equipment types. AHRI also indicates there is a lack of components designed for R-290 for capacities between 3,000 and 12,000 million British thermal units per hour (MBtu/hour), which preclude that alternative's use in larger stand-alone units, especially those with open cases (i.e., no doors). They also state that the 150-gram limit established by EPA as a use condition for R-290 leads to needing multiple smaller compressor systems for such larger equipment, which requires more space to house and leads to equipment designs that would not comply with the ADA. Further to the point of ADA compliance, AHRI indicates that the thermodynamic properties of the other alternatives (such as R-450A and R-513A) are such that larger components are needed to achieve the same amount of cooling, and that these larger components lead to designs conflicting with requirements of the ADA such as counter height. AHRI provided information (see presentation titled "AHRI Petition for SNAP Approval of R-448A, R-449A&B In Medium Temperature Stand-Alone Commercial Refrigeration Equipment" in Docket EPA-HQ-OAR-2019-0698) that evaluated the capacity and efficiency of relevant equipment using R-450A and R-513A, two acceptable alternatives, and for R-448A, R-449A and R-449B. In the larger units (1 horsepower and above), their results showed 6% to 29% lower capacities with the two acceptable alternatives compared to R-404A, while R-448A, R-449A and R-449B showed capacities up to 7% better compared to R-404A. This information suggests that certain equipment configurations would require significantly larger refrigeration equipment that could jeopardize compliance with ADA for those types of equipment.

Regarding the efficiency standards, EPA previously noted that medium-temperature stand-alone units would fall under a classification ending in .SC.M within the DOE regulations

(80 FR 42902, July 20, 2015). Several codes could precede .SC.M to indicate the unit design (e.g., horizontal or vertical, open or with doors). As also discussed in that rule, “EPA does not have a practice in the SNAP program of including ... energy efficiency in the overall risk analysis. We do consider issues such as technical needs for energy efficiency (e.g., to meet DOE standards) in determining whether alternatives are ‘available.’” However, EPA also explained “that the refrigerant is only one of many factors affecting energy efficiency. Moreover, even as refrigerant transitions have taken place over past decades, we have seen improved energy efficiency. This is often due to equipment redesigns and technology advancements that include factors besides the choice of refrigerant.” (80 FR 42946, July 20, 2015). Therefore, for this proposed rule, EPA is not basing our proposed listing decision on energy efficiency, although the Agency has previously indicated that an analysis of equipment performance could be part of the evaluation required to use R-448A, R-449A, and R-449B under the proposed narrowed use limit.

Third, AHRI indicates that a design alternative—reconfiguring stand-alone units into remote condensing units—would likely lead to higher emissions. EPA listed R-448A, R-449A and R-449B as acceptable for remote condensing units (80 FR 42053, July 16, 2015; 81 FR 70029, October 11, 2016). The choice of using such a design alternative, however, is not germane to this proposal, which is evaluating the use of these refrigerants in medium-temperature stand-alone equipment. Therefore, for this proposed rule, EPA is not basing our proposed listing decision on the fact that such a design alternative exists.

Fourth, AHRI notes that some equipment is designed to meet both low- and medium-temperature conditions, requiring more complex designs with a risk of refrigerant cross-contamination if R-448A, R-449A, or R-449B was used for the low-temperature range but was not acceptable for the medium-temperature range. As explained above, the complexity of

designing equipment is not part of the SNAP review criteria.

Fifth, AHRI claims that the cost to redesign equipment to an acceptable refrigerant like R-450A or R-513A would be high. EPA noted in the 2015 Rule that only certain elements of cost are part of the SNAP criteria. We stated that “under the SNAP criteria for review in 40 CFR 82.180(a)(7), the only cost information that EPA considers as part of its SNAP review is the cost of the substitute under review.” (80 FR 42898, July 15, 2015). Because the cost to redesign equipment is not part of the SNAP criteria, EPA is not basing our proposed listing decision on such costs.

4. What is EPA proposing for R-448A, R-449A and R-449B?

EPA understands that to construct certain medium-temperature stand-alone units with the available acceptable refrigerants would require significantly larger components, or the addition of multiple refrigeration systems, which may lead to redesigning the units in such a manner that could be inconsistent with the ADA requirements. AHRI specifically pointed to R-448A, R-449A, and R-449B as refrigerants that would, on the contrary, be feasible in such equipment and requested that those refrigerants be added to the list of acceptable refrigerants for new medium-temperature stand-alone units.

Given the concern about designing equipment capable of complying with ADA requirements, EPA is proposing to list R-448A, R-449A, and R-449B as acceptable, subject to narrowed use limits, for this end-use category. Users, including manufacturers, using a substitute listed as acceptable, subject to narrowed use limits, must ascertain that other substitutes or alternatives are not technically feasible. As explained in the initial SNAP rulemaking (59 FR 13063, March 18, 1994), under the narrowed use limit, “Users are expected to undertake a thorough technical investigation of alternatives before implementing the otherwise restricted

substitute” (i.e., R-448A, R-449A or R-449B for this proposal). Further, “[t]he Agency expects users to contact vendors of alternatives to explore with experts whether or not other acceptable substitutes are technically feasible for the process, product or system in question” (i.e., in new medium-temperature stand-alone units for this proposal) to the otherwise restricted substitute. The initial SNAP rule also explained that “[a]lthough users are not required to report the results of their investigations to EPA, companies must document these results, and retain them in company files for the purpose of demonstrating compliance” for up to five years after the date of creation of the records. In this circumstance, “users” would generally be considered the manufacturers producing medium temperature stand-alone equipment using one of these three substitutes. This information includes descriptions of:

- Process or product in which the substitute is needed;
- Substitutes examined and rejected;
- Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or
- Anticipated date other substitutes will be available and projected time for switching.

An example of a viable explanation under a narrowed use limit should include information such as a market analysis of the components for other alternatives that indicate a lack of availability in the required sizes or with required features, or design diagrams that indicate excessive loss of refrigerated volumes or failure to meet ADA requirements.

At this time, EPA does not have sufficient information indicating that there is any other basis that would preclude use of other available alternatives. Regarding AHRI’s concerns about the cost of redesigning equipment to use the currently acceptable alternatives, as explained in previous rulemakings referenced above, EPA does not consider the cost of transitioning to

alternatives in making listing decisions. In addition, the fact, on its own, that designs using a safer alternative may be more complex is not a sufficient basis to list a substitute that poses greater risk as acceptable. EPA is taking comment on the proposed listings as well as the specific narrowed use limits discussed above.

B. Residential and light commercial air conditioning and heat pumps - Proposed listing of R-452B, R-454A, R-454B, R-454C, and R-457A as acceptable, subject to use conditions, for use in residential and light commercial air conditioning and heat pumps end-use for new equipment; and R-32 as acceptable, subject to use conditions, for use in residential and light commercial air conditioning and heat pumps—equipment other than self-contained room air conditioners, for new equipment

EPA previously listed R-32 as acceptable subject to use conditions as a substitute in residential and light commercial air conditioning and heat pumps for self-contained room air conditioners, including packaged terminal air conditioners (PTACs), packaged terminal heat pumps (PTHPs), window AC units, portable room AC equipment, and wall-mounted self-contained ACs (80 FR 19454, April 10, 2015).²¹ This proposed rulemaking is proposing to find R-32 acceptable, subject to use conditions, for self-contained ACs that are typically larger than room-size (e.g. rooftop units, water-source heat pumps, and ground-source heat pumps) and split systems, as explained below, which are part of the residential and light commercial air conditioning and heat pump end-use. For convenience, in this proposed rule we discuss the proposed listing decision for R-32 together with the proposed decision for R-452B, R-454A, R-454B, R-454C, and R-457A (hereafter called “the five refrigerant blends”) but we note here that

²¹ In this proposed rule, we use the term “air conditioner” and “AC” to cover equipment that cools air, heats air, or has the function to do both (typically referred to as a “heat pump”). While such equipment might humidify or dehumidify the air, the term does not include equipment whose purpose is for latent cooling only (i.e., dehumidifiers), which are a separate end-use under SNAP.

this proposed decision for R-32 is not a proposal to revisit or modify the existing acceptable subject to use conditions listing for R-32 for self-contained room air conditioners.

EPA proposes to list the five refrigerant blends (i.e., R-452B, R-454A, R-454B, R-454C, and R-457A) as acceptable subject to use conditions as substitutes in residential and light commercial air conditioning and heat pumps for both self-contained and split systems and R-32 as acceptable subject to use conditions in residential and light commercial air conditioning and heat pumps for split systems and for specific types of self-contained systems that are part of the residential and light commercial air conditioning and heat pump end-use but for which R-32 has not been previously listed.

EPA proposes the following use conditions:

(1) UL Standard—These refrigerants may be used only in AC equipment, both self-contained equipment and split-systems, that meet all requirements listed in the 3rd edition, dated November 1, 2019, of Underwriters Laboratories (UL) Standard 60335-2-40, “Household And Similar Electrical Appliances - Safety - Part 2-40: Particular Requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifiers” (UL Standard). If this rule is finalized as proposed, in cases where the final rule would include requirements different than those of the 3rd edition of UL Standard 60335-2-40, the appliance would need to meet the requirements of the final rule in place of the requirements in the UL Standard. See section II.B.4 of the preamble for further discussion on the requirements of this standard that EPA is proposing to incorporate by reference.

(2) New equipment only—These refrigerants may be used only in new equipment designed specifically and clearly identified for the refrigerant; i.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment.

(3) Warning labels—The following markings, or the equivalent, must be provided in letters no less than 6.4 mm (¼ inch) high and must be permanent:

(a) On the outside of the air conditioning equipment: “WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing”

(b) On the outside of the air conditioning equipment: “WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used”

(c) On the inside of the air conditioning equipment near the compressor: “WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed”

(d) For any equipment pre-charged at the factory, on the equipment packaging: “WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations”

(e) On the indoor unit²² near the nameplate:

- a. At the top of the marking: “Minimum Installation height, X m (W ft)”. This marking is only required if the similar marking is required by the 3rd edition of UL 60335-2-40. The terms “X” and “W” shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.

²² This labeling is required for split systems and self-contained equipment alike.

- b. Immediately below (a) above or at the top of the marking if (a) is not required:

“Minimum room area (operating or storage), Y m² (Z ft²)”. The terms “Y” and “Z” shall be replaced by the numeric area as calculated per the UL Standard.

Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.

(f) For non-fixed equipment, including portable air conditioners, window air conditioners, packaged terminal air conditioners and packaged terminal heat pumps, on the outside of the product: “WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition.”

(g) For fixed equipment, including rooftop units and split air conditioners, “WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”

(4) Markings—Equipment must have distinguishing red (Pantone[®] Matching System (PMS) #185 or RAL 3020) color-coded hoses and piping to indicate use of a flammable refrigerant. The air conditioning equipment shall have marked service ports, pipes, hoses and other devices through which the refrigerant is serviced. Markings shall extend at least 1 inch (25mm) from the servicing port and shall be replaced if removed.

The regulatory text of the proposed decisions appears in tables at the end of this document. If finalized as proposed, this text would be codified in appendix W of 40 CFR part 82 subpart G. The proposed regulatory text contains listing decisions for the end-uses discussed above. EPA notes that there may be other legal obligations pertaining to the manufacture, use,

handling, and disposal of the proposed refrigerants that are not included in the information listed in the tables (e.g., the CAA section 608(c)(2) prohibition on knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration, or Department of Transportation requirements for transport of flammable gases). Mildly flammable refrigerants being recovered or otherwise disposed of from residential and light commercial air conditioning appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260-270).

1. Background on residential and light commercial air conditioning and heat pumps

The residential and light commercial air conditioning and heat pumps end-use includes equipment for cooling air in individual rooms, in single-family homes, and in small commercial buildings. Heat pumps are equipment types that heat, or have the option to either cool or heat, air for such locations. This end-use differs from commercial comfort AC, which uses chillers that cool water that is then used to cool air throughout a large commercial building, such as an office building or hotel. This end-use includes both self-contained and split systems. Self-contained systems include some rooftop AC units (e.g., those ducted to supply conditioned air to multiple spaces) and many types of room ACs, including PTACs, PTHPs, some rooftop AC units, window AC units, portable room AC units, and wall-mounted self-contained ACs, designed for use in a single room. Split systems include ducted and non-ducted mini-splits (which might also be designed for use in a single room), multi-splits and variable refrigerant flow (VRF) systems, and ducted unitary splits. Water-source and ground-source heat pumps often are packaged systems similar to the self-contained equipment described above but could be applied with the condenser separated from the other components similar to split systems. Examples of equipment

for residential and light commercial AC and heat pumps include:

- Central air conditioners, also called unitary AC or unitary split systems. These systems include an outdoor unit with a condenser and a compressor, refrigerant lines, an indoor unit with an evaporator, and ducts to carry cooled air throughout a building. Central heat pumps are similar but offer the choice to either heat or cool the indoor space.
- Multi-split air conditioners and heat pumps. These systems include one or more outdoor unit(s) with a condenser and a compressor and multiple indoor units, each of which is connected to the outdoor unit by refrigerant lines. Non-ducted multi-splits provide cooled or heated air directly from the indoor unit rather than providing the air through ducts.
- Mini-split air conditioners and heat pumps. These systems include an outdoor unit with a condenser and a compressor and a single indoor unit that is connected to the outdoor unit by refrigerant lines. Non-ducted mini-splits provide cooled or heated air directly from the indoor unit rather than being carried through ducts.
- Rooftop AC units. These are units that combine the compressor, condenser and evaporator in a single package and may contain additional components for filtration and dehumidification. Most units also include dampers to control air intake. Rooftop AC units cool or heat outside air that is then delivered to the space directly through the ceiling or through a duct network. Rooftop AC units are common in small commercial buildings such as a single store in a mall with no indoor passageways between stores (i.e., a “strip-mall”). They can also be set up in an array to provide cooling or heating throughout a larger commercial establishment such as a

department store or supermarket.

- Window air conditioners. These are self-contained units that fit in a window with the condenser extending outside the window.
- PTACs and PTHPs. These are self-contained units that consist of a separate, un-encased combination of heating and cooling assemblies mounted through a wall. PTACs and PTHPs are intended for use in a single room and use no ducts to carry cooled air and no external refrigerant lines. Typical applications include motel or dormitory air conditioners.
- Portable room air conditioners. These are self-contained units that are designed to be moved easily from room to room, usually having wheels. They may contain an exhaust hose that can be placed through a window or door to eject heat to the outside.
- Water-source heat pumps (WSHPs) and ground-source heat pumps (GSHPs). These are similar to unitary split systems except that heat is ejected (when in cooling mode) from the condenser through a second circuit rather than directly with outside air. The second circuit transfers the heat to the ground, ground water, or another body of water such as a lake using water, or a brine could be used if temperatures would risk freezing. Some systems can perform heating in a similar matter with the refrigerant circuit running in reverse; regardless, the term “heat pump” is most often used.

All of these types of air conditioning equipment would be subject to the listing decisions under this rule for the identified substitutes if those decisions become final.²³

Of these types of equipment, window air conditioners, PTACs, PTHPs, rooftop AC units, portable room air conditioners, and often GSHPs and WSHPs are self-contained equipment with

²³ As noted above, self-contained room air conditioners using R-32 would not be affected by this proposed rule.

the condenser, compressor, evaporator, and tubing all within casing in a single unit. In contrast, unitary split systems, multi-split systems and mini-split systems have an outdoor condenser that is separated from an indoor unit. Compared to split systems, self-contained equipment typically has smaller charge sizes, has fewer locations that are prone to leak, and is less likely to require servicing by a technician. These types of air conditioning equipment—both self-contained and split systems—all fall under the scope of the UL 60335-2-40 standard “Household And Similar Electrical Appliances - Safety - Part 2-40: Requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifiers.”

2. What are the ASHRAE classifications for refrigerant flammability?

The American National Standards Institute /American Society of Heating, Refrigerating and Air Conditioning Engineers (ANSI/ASHRAE) Standard 34–2019 assigns a safety group classification for each refrigerant which consists of two to three alphanumeric characters (e.g., A2L or B1). The initial capital letter indicates the toxicity and the numeral denotes the flammability. ASHRAE classifies Class A refrigerants as refrigerants for which toxicity has not been identified at concentrations less than or equal to 400 ppm by volume, based on data used to determine threshold limit value-time-weighted average (TLV–TWA) or consistent indices. Class B signifies refrigerants for which there is evidence of toxicity at concentrations below 400 ppm by volume, based on data used to determine TLV–TWA or consistent indices.

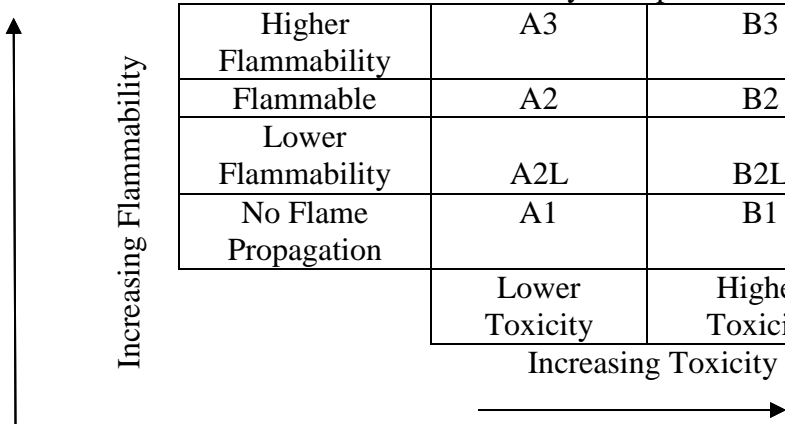
The refrigerants are also assigned a flammability classification of 1, 2, 2L, or 3. Tests for flammability are conducted in accordance with American Society for Testing and Materials (ASTM) E681 using a spark ignition source at 140°F (60 °C) and 14.7 psia (101.3 kPa)²⁴. The flammability classification “1” is given to refrigerants that, when tested, show no flame

²⁴ ASHRAE, 2019. ANSI/ASHRAE Standard 34–2019: Designation and Safety Classification of Refrigerants

propagation. The flammability classification “2” is given to refrigerants that, when tested, exhibit flame propagation, have a heat of combustion less than 19,000 kJ/kg (8,169 Btu/lb), and have a lower flammability limit (LFL) greater than 0.10 kg/m³. The flammability classification “2L” is given to refrigerants that, when tested, exhibit flame propagation, have a heat of combustion less than 19,000 kJ/kg (8,169 BTU/lb), have an LFL greater than 0.10 kg/m³, and have a maximum burning velocity of 10 cm/s or lower when tested at in dry air at 73.4°F (23.0 °C) and 14.7 psia (101.3 kPa). The flammability classification “3” is given to refrigerants that, when tested, exhibit flame propagation and that either have a heat of combustion of 19,000 kJ/kg (8,169 BTU/lb) or greater or have an LFL of 0.10 kg/m³ or lower.

For flammability classifications, refrigerant blends are designated based on the worst case of formulation for flammability and the worst case of fractionation for flammability determined for the blend.

Figure 1. Refrigerant Safety Group Classification



Safety Group		
Higher Flammability	A3	B3
Flammable	A2	B2
Lower Flammability	A2L	B2L
No Flame Propagation	A1	B1
	Lower Toxicity	Higher Toxicity

Using these safety group classifications, ANSI/ASHRAE Standard 34–2019 categorizes R-32 and the five refrigerant blends in this section of the proposed rulemaking in the A2L Safety Group.

3. What are R-32, R-452B, R-454A, R-454B, R-454C and R-457A and how do they compare to other refrigerants in the same end-use?

R-32 is a mildly flammable refrigerant, and the five refrigerant blends are mildly flammable refrigerant blends, all with an ASHRAE safety classification of A2L. The respective CAS Reg. Nos. of R-32 and the components of the five refrigerant blends are listed below.

R-32 is also known as HFC-32 or difluoromethane (CAS Reg. No. 75-10-5). EPA previously listed R-32 as an acceptable refrigerant for some types of residential and light commercial air conditioning and heat pumps end-use categories, specifically self-contained room air conditioners such as window units, PTACs, PTHPs, portable room AC, and wall-mounted AC (80 FR 19454, April 10, 2015). As noted above, this proposal would add a listing for this substitute to include rooftop units, GSHPs and WSHPs, which are typically self-contained but not sized for a single room, and various types of split systems.

R-452B, also known by the trade name “Opteon™ XL 55,” and also known as “Solstice® L41y,” is a mildly flammable blend consisting of 67 percent by weight HFC-32; seven percent HFC-125, also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); and 26 percent HFO-1234yf, also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1). R-454A, also known by the trade name “Opteon™ XL 40,” is a mildly flammable blend consisting of 35 percent HFC-32 and 65 percent HFO-1234yf. R-454B, also known by the trade names “Opteon™ XL 41” and “Puron Advance™,” is a mildly flammable blend consisting of 68.9 percent HFC-32 and 31.1 percent HFO-1234yf. R-454C, also known by the trade name “Opteon™ XL 20,” is a mildly flammable blend consisting of 21.5 percent HFC-32 and 78.5 percent HFO-1234yf. R-457A, also known by the trade name “Forane® 457A,” is a mildly flammable blend consisting of 70 percent HFO-1234yf, 18 percent HFC-32, and 12 percent

HFC-152a, which is also known as ethane, 1,1-difluoro (CAS Reg. No. 75-37-6).

Redacted submissions and supporting documentation for R-32 and the five refrigerant blends are provided in the docket for this proposed rule (EPA-HQ-OAR-2019-0698) at <https://www.regulations.gov>. EPA performed an assessment to examine the health and environmental risks of each of these substitutes. These assessments are available in the docket for this proposed rule.^{25 26 27 28 29 30}

Environmental information: R-32 and the five refrigerant blends have ODPs of zero.

R-32 has a GWP of 675. The five refrigerant blends are made up of the components HFC-32, HFC-125, HFO-1234yf and HFC-152a, which have GWPs of 675, 3,500, one to four, and 124, respectively.³¹ If these values are weighted by mass percentage, then R-452B, R-454A, R-454B, R-454C and R-457A have GWPs of about 700, 240, 470, 150 and 140 respectively.

HFC-32, HFC-125, HFC-134a, HFC-152a, HFO-1234yf and HFO-1234ze(E)—the components of the five refrigerant blends—and R-32 are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or otherwise knowingly releasing or disposing of these refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration is prohibited as provided in section 608(c)(2) of the CAA and

²⁵ ICF, 2020d. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: HFC-32.

²⁶ ICF, 2020e. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: R-452B.

²⁷ ICF, 2020f. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: R-454A.

²⁸ ICF, 2020g. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: R-454B.

²⁹ ICF, 2020h. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: R-454C.

³⁰ ICF, 2020i. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps; Substitute (New Equipment): R-457A.

³¹ See section II.A.2 for sources of these GWP values.

EPA's regulations at 40 CFR 82.154(a)(1).

Flammability information: R-32 and the five refrigerant blends are mildly flammable. All have an ASHRAE flammability classification of 2L.

Toxicity and exposure data: Potential health effects of exposure to these substitutes include drowsiness or dizziness. The substitutes may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitutes may cause irregular heartbeat. The substitutes could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-32 and the component refrigerants HFC-125 and HFC-152a; the AIHA has established a WEEL of 500 ppm as an 8-hr TWA for HFO-1234yf. The manufacturer of R-452B, R-454A, R-454B, and R-454C recommends AELs, respectively, of 874, 690, 854, and 615 ppm on an 8-hr TWA for these blends. EPA anticipates that users will be able to meet the AIHA WEEL and manufacturers' AELs and address potential health risks by following requirements and recommendations in the manufacturers' SDS, in ASHRAE Standard 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in this end-use: R-32 and the five refrigerant blends all have an ODP of zero, the same as other acceptable substitutes in this end-use.

R-32 and the five refrigerant blends' GWPs, ranging from 140 to 700, are higher than some of the acceptable substitutes for residential and light commercial air conditioning and heat pumps, including ammonia absorption, R-290, and R-441A³² with GWPs ranging from zero to

³² R-290 and R-441A are only acceptable in new self-contained room air conditioning equipment, subject to use conditions.

three. R-32 and the five refrigerant blends' GWPs are lower than some of the acceptable substitutes for residential and light commercial air conditioning and heat pumps, such as HFC-134a, R-410A, and R-507A with GWPs of 1,430, 2,090 and 3,990 respectively.

Information regarding the toxicity of other available alternatives are provided in the listing decisions previously made (see <https://www.epa.gov/snap/substitutes-residential-and-light-commercial-air-conditioning-and-heat-pumps>). Toxicity risks are comparable to or lower than toxicity risks of other available substitutes in the same end-use. Toxicity risks can be minimized by use consistent with ASHRAE 15 and other industry standards, recommendations in the manufacturers' SDS, and other safety precautions common in the refrigeration and air conditioning industry.

Although flammability risk may be greater than flammability risks of other available substitutes in the same end-use, this risk can be minimized by use consistent with ASHRAE 15 and other industry standards such as UL 60335-2-40, recommendations in the manufacturers' SDS, and other safety precautions common in the refrigeration and air conditioning industry. EPA is proposing use conditions to reduce the potential risk associated with the flammability of these alternatives so that they will not pose significantly greater risk than other acceptable substitutes in this end-use.

4. Why is EPA proposing these specific use conditions?

EPA is proposing to list the five refrigerant blends as acceptable, subject to use conditions, for use in the residential and light commercial air conditioning and heat pumps end-use for both self-contained and splits systems for new equipment. EPA is also proposing to list R-32 as acceptable, subject to use conditions, for use in the residential and light commercial air conditioning and heat pumps end use for split systems and certain types of self-contained

equipment for new equipment. As explained above, EPA is not proposing to change the existing listing of R-32 as acceptable, subject to use conditions, in self-contained room ACs (e.g., window units, PTACs, PTHPs, portable room ACs, and wall-mounted self-contained ACs). The use conditions are identified in the listing under subheading II.B, above, and are explained here in greater detail. The use conditions EPA proposes include conditions requiring use of each refrigerant in new equipment, which can be specifically designed for the refrigerant; use consistent with the UL 60335-2-40 industry standard, including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and revisions to the requirements for warnings and markings on equipment to inform consumers and technicians of potential flammability hazards. The listings with specific use conditions are intended to allow for the use of these mildly flammable refrigerants in a manner that will ensure they do not pose a greater overall risk to human health and the environment than other substitutes in this end-use. We seek comment on the proposed listings including the specific use conditions discussed below.

New Equipment Only; Not intended for Use as a Retrofit Alternative

EPA is proposing that these refrigerants may be used only in new equipment³³ which has been designed to address concerns unique to flammable refrigerants—i.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment. These flammable refrigerants were not submitted under the SNAP program to be used in retrofitted equipment, and no information was provided on how to address hazards if these flammable refrigerants were to be used in equipment that was designed for non-flammable refrigerants.

Therefore, EPA is only proposing that these refrigerants may be used in new equipment which

³³ This is intended to mean a completely new refrigeration circuit containing a new compressor, evaporator, condenser and refrigerant tubing.

can be properly designed for their use.

Standards

EPA is proposing that the flammable refrigerants may be used only in equipment that meets all requirements in UL Standard 60335-2-40, Edition 3 for air conditioning equipment. This UL Standard indicates that refrigerant charges greater than a specific amount (called “m₃” in the UL Standard and based on the refrigerant’s LFL) are beyond its scope and that national standards might apply, such as for instance ANSI/ASHRAE 15-2019. Because EPA has not evaluated such situations, this proposal only covers equipment that fits within the scope of the UL Standard.

Those participating in the UL 60335-2-40 consensus standards process (hereafter “UL”) have tested equipment for flammability risk in residential applications and evaluated the relevant scientific studies. Further, UL has developed safety standards including requirements for construction and system design, for markings, and for performance tests concerning refrigerant leakage, ignition of switching components, surface temperature of parts, and component strength after being scratched. Certain aspects of system construction and design, including charge size, ventilation, and installation space, and greater detail on markings, are discussed further below in this section. The UL 60335-2-40 Standard was developed in an open and consensus-based approach, with the assistance of experts in the air conditioning industry as well as experts involved in assessing the safety of products. While similar standards exist from other bodies such as the International Electrotechnical Commission, we are proposing to rely on specific UL standards that are most applicable and recognized by the U.S. market. This approach is the same as that in our previous rules on flammable refrigerants (e.g. 76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015).

A summary of the requirements of UL 60335-2-40 as they affect the refrigerants and end-use addressed in this section of our proposal follows. This summary is offered for information only and does not provide a complete review of the requirements in this standard.

Among the provisions in UL 60335-2-40 are limits on the amount of refrigerant allowed in each type of appliance based on several factors explained in that standard. The requirements in UL 60335-2-40 would reduce the risk to workers and consumers.

The limitations on refrigerant charge size for residential and light commercial air conditioning and heat pumps would be required in accordance with UL 60335-2-40, Edition 3. As discussed above in this section, EPA believes UL standards are most applicable to the U.S. market and offer requirements developed by a consensus of experts. EPA is proposing to require charge size limits for each of the proposed refrigerants by equipment type in accordance with UL 60335-2-40, Edition 3. Annex GG of the standard provides the charge limits, ventilation requirements and requirements for secondary circuits. The standard specifies requirements for installation space of an appliance (i.e., room floor area) and/or ventilation or other requirements which are determined according to the refrigerant charge used in the appliance, the installation location and the type of ventilation of the location or of the appliance. Within Annex GG, Table GG.1 provides guidance on how to apply the requirements to allow for safe use of flammable refrigerants. UL 60335-2-40, Edition 3 contains provisions for safety mitigation. These mitigation requirements were developed to ensure the safe use of flammable refrigerants over a range of appliances. In general, as larger charge sizes are used, more stringent mitigation requirements are required. In certain applications refrigerant detection systems (as described in Annex LL, *Refrigerant detection systems for A2L refrigerants*) and refrigerant sensors (as described in Annex MM, *Refrigerant sensor location confirmation tests*) such as safety alarms

are required. Where mechanical ventilation (i.e., fans) is required in accordance with Annex GG or Annex 101.DVG, it must be initiated by a separate refrigerant detection system either as part of the appliance or installed separately. In a room with no mechanical ventilation, Annex GG provides requirements for openings to rooms based on several factors, including the charge size and the room area. The minimum opening is intended to be sufficient so that natural ventilation would reduce the risk of using a flammable refrigerant. The standard also includes specific requirements for split system appliances covering construction, instruction manuals, and allowable charge sizes, mechanical ventilation, safety alarms, and shut off valves for A2L refrigerants.

In addition to Annex GG and Table GG.1 mentioned above, UL 60335-2-40 has a requirement for the maximum charge for an appliance using an A2L refrigerant. If the appliance is a portable appliance, a non-fixed factory-sealed single package, or a cord-connected appliance which may be periodically or seasonally relocated (excluding servicing) by the end user, there are no additional requirements for room area, ventilation, or other risk mitigation if the charge is sufficiently small—under three times the LFL. Additional requirements exist for charge sizes exceeding three times the LFL.

Labeling

As a use condition, EPA is proposing to require labeling of residential and light commercial air conditioning and heat pump equipment. EPA would require the warning labels on the equipment contain letters at least ¼ inch high. The label must be permanently affixed to the equipment. Warning label language requirements are described in Section II.B of this proposed rule, “Residential and light commercial air conditioning and heat pumps end-use.” The warning label language is similar to or exactly the same as that required in UL 60335-2-40.

The major difference between this proposed requirement and the requirements in Table 101.DVF.1 of UL 60335-2-40 is that the markings for A2L refrigerants, including R-32 and the five refrigerant blends (i.e., R-452B, R-454A, R-454B, R-454C and R-457A), are required to be no less than 3.2 mm ($\frac{1}{8}$ inch) high in the standard instead of 6.4 mm ($\frac{1}{4}$ inch) as EPA is proposing in this action. EPA believes that it would be difficult to see warning labels with the minimum lettering height requirement for A2L refrigerants of $\frac{1}{8}$ inch in the UL Standard. Therefore, as in the requirements in our previous flammable refrigerants rules (e.g., 76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015), EPA is proposing that the minimum height for lettering must be $\frac{1}{4}$ inch as opposed to $\frac{1}{8}$ inch, which will make it easier for technicians, consumers, retail storeowners, first responders, and those disposing the appliance to view the warning labels.

EPA is requesting comment on requiring labeling, the height of the lettering, and the likelihood of labels remaining on a product throughout the lifecycle of the product, including its disposal.

Markings

Our understanding of the UL Standard is that red markings, similar to those EPA has applied as use conditions in past actions for flammable refrigerants (76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015), are required by the UL Standard for A2 and A3 refrigerants but not A2L refrigerants. EPA is proposing that such markings apply to these A2L refrigerants as well to establish a common, familiar and standard means of identifying the use of a flammable refrigerant.

These red markings will help technicians immediately identify the use of a flammable refrigerant, thereby potentially reducing the risk of using sparking equipment or otherwise

having an ignition source nearby. The AC and refrigeration industry currently uses red-colored hoses and piping as means for identifying the use of a flammable refrigerant based on previous SNAP listings. Likewise, distinguishing coloring has been used elsewhere to indicate an unusual and potentially dangerous situation, for example in the use of orange-insulated wires in hybrid electric vehicles. Currently in SNAP listings, color-coded hoses or pipes must be used for ethane, HFC-32, isobutane, propane, or R-441A in certain types of equipment. All such tubing must be colored red PMS #185 or RAL 3020 to match the red band displayed on the container of flammable refrigerants under the AHRI Guideline N, “2016 Guideline for Assignment of Refrigerant Container Colors.” EPA wants to ensure that there is adequate notice for technicians and others that a flammable refrigerant is being used within a particular piece of equipment or appliance. EPA is also concerned with ensuring adequate notification of the presence of flammable refrigerants for personnel disposing of appliances containing flammable refrigerants. As explained in a previous SNAP rule, one mechanism to distinguish hoses and pipes is to add a colored plastic sleeve or cap to the service tube. (80 FR 19465, April 10, 2015). The colored plastic sleeve or cap would have to be forcibly removed in order to access the service tube. This would signal to the technician that the refrigeration circuit that she/he was about to access contained a flammable refrigerant, even if all warning labels were somehow removed. This sleeve would be of the same red color (PMS #185 or RAL 3020) and could also be boldly marked with a graphic to indicate the refrigerant was flammable. This could be a cost-effective alternative to painting or dyeing the hose or pipe.

EPA is proposing the use of color-coded hoses or piping as a way for technicians and others to recognize that a flammable refrigerant is used in the equipment. This would be in addition to the proposed use of warning labels discussed above. EPA believes having two such

warning methods is reasonable and consistent with other general industry practices. This approach is the same as that adopted in our previous rules on flammable refrigerants (e.g., 76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015).

5. What additional information is EPA including in these listings?

EPA is including recommendations, found in the “Further information” column of the regulatory text at the end of this document, to protect personnel from the risks of using flammable refrigerants. Similar to our previous listing of flammable refrigerants for this end-use (80 FR 19454, April 10, 2015), EPA is including information on the U.S. Occupational Safety and Health Administration (OSHA) requirements at 29 CFR part 1910, proper ventilation, personal protective equipment, fire extinguishers, use of spark-proof tools and equipment designed for flammable refrigerants, and training.

Since this additional information is not part of the regulatory decision, these statements would not be binding for the proposed use of the substitutes under the SNAP program. However, the information so listed may be binding under other regulatory programs (e.g., worker protection regulations promulgated by OSHA). The “Further Information” identified in the proposed listing does not necessarily include all other legal obligations pertaining to the use of the substitutes. While the items listed would not be legally binding under the SNAP program, EPA would encourage users of substitutes to apply all statements in the “Further Information” column in their use of these substitutes if this proposal is finalized. In many instances, the information simply refers to sound operating practices that have already been identified in existing industry and/or building codes or standards. Thus, many of the statements, if adopted, would not result in the user making significant changes in existing operating practices.

EPA notes that Annex HH of UL 60335-2-40, *Competence of service personnel*, provides

guidelines for service personnel to ensure they receive training specifically to address potential risks of servicing equipment using flammable refrigerants. Annex HH provides recommendations that such training cover several aspects relevant to flammable refrigerants including recognition of ignition sources, information about refrigerant detectors, and other safety concepts. Additional training information recommended would address the proper working procedures for equipment commissioning, maintenance, repair, decommissioning and disposal. The Agency notes that this section of the UL Standard is described as informational, rather than “normative,” i.e., it is intended to provide information but not to be an absolute requirement under the UL standard. Because Annex HH is informative, rather than normative, it is not a requirement of the UL Standard and following it would not be required under our proposed use conditions. Nonetheless, in this proposal, EPA is providing as “Further information” some information on training, including a recommendation that personnel follow Annex HH.

6. On what aspects is EPA requesting additional comment?

In the past, when finding flammable refrigerants acceptable subject to use conditions for self-contained equipment, EPA considered a requirement for training but decided that industry is better suited than EPA to design the content of any such training. At the time, this UL Standard did not exist, and the UL standards that EPA incorporated by reference did not contain a similar informative annex on training. EPA expected that the use conditions would be met by work performed at the factory in a controlled environment. Consistent with past SNAP rules on flammable refrigerants in refrigeration and air conditioning equipment (e.g. 76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015), EPA is not proposing to require specific training or service practices. However, the Agency is interested in comments on whether this

approach should still be followed or if, through a separate rulemaking, EPA should propose to establish training and service requirements, and, if so, how such a training program might be managed and to what extent or for which types of products such requirements should apply. EPA is particularly interested in comments on requiring training for personnel working with split systems because this equipment is generally charged in the field. EPA likewise is interested in comments on the extent to which the use conditions including the UL Standard requirements can be addressed at the factory by trained factory employees in a controlled environment with limited access by the general public, for self-contained equipment and split systems. EPA will consider these comments in determining whether to initiate a separate rulemaking to establish specific service practices and training on the use of flammable refrigerants in this end use.

C. Extruded polystyrene: boardstock and billet—Proposed listing of blends of 40 to 52 percent HFC-134a by weight and the remainder HFO-1234ze(E); blends of 40 to 52 percent HFC-134a with 40 to 60 percent HFO-1234ze(E) and 10 to 20 percent each water and CO₂ by weight; and blends with maximum of 51 percent HFC-134a, 17 to 41 percent HFC-152a, up to 20 percent CO₂ and one to 13 percent water

EPA is proposing to list three blends containing HFC-134a as acceptable blowing agents in extruded polystyrene: boardstock and billet (XPS): blends of 40 to 52 percent HFC-134a by weight and the remainder HFO-1234ze(E); blends of 40 to 52 percent HFC-134a with 40 to 60 percent HFO-1234ze(E) and 10 to 20 percent each water and CO₂ by weight; and blends with maximum of 51 percent HFC-134a, 17 to 41 percent HFC-152a, up to 20 percent CO₂ and one to 13 percent water. EPA is also proposing to revise the unacceptable listing for blends of certain HFCs in XPS for consistency with the acceptable listings for these blends of HFC-134a.

1. Background on XPS

The foam blowing end-use for XPS includes insulation for roofing, walls, floors, and pipes. This type of insulation foam can provide both thermal insulation and protection against moisture. XPS products have a variety of sizes and densities with differing technical requirements. XPS billet consists of thick blocks that may be used for flotation or for fabrication into shapes, such as for insulation of pipes or fittings. XPS boards are extruded through a die at high temperatures (approximately 90 ° C). Flammability of the blowing agent and of the foam formulation is a potential hazard that may be addressed in a number of ways, including engineering controls such as ventilation and use of explosion-proof materials and/or use of less flammable blowing agents. In some cases, foam blowing agents may be pre-blended in a container. In other cases, multiple blowing agents are introduced during blowing of the foam, or “co-blown.”

UL, Factory Mutual (FM), or another organization may test the final foam product for consistency with ASTM Standard C578, “Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation,” so that the foam qualifies for meeting building codes.³⁴ The foam undergoes testing for properties such as density, thermal resistance (“R-value”), compressive strength, flexural strength, water vapor permeance, water absorption, dimensional stability, flame spread, and smoke generation to meet building codes.³⁵ Flame spread and smoke testing is conducted according to ASTM E84, “Standard Test Method for Surface Burning Characteristics of Building Materials.” Flame retardants may need to be added to the foam’s composition to meet flame spread and smoke testing requirements. There may be additional tests such as for heat and ultraviolet radiation sensitivity for XPS manufactured for roofing applications.

³⁴ In Canada, the applicable standard is CAN/ULC-S701, “Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.”

³⁵ Source: Extruded Polystyrene Foam Association, webpage for technical information on standards.
<http://xpsa.com/tech-info-standards.html>

XPS historically used CFC-12 as a blowing agent and then transitioned to use of HCFC-22 and/or HCFC-142b. EPA listed HCFC-22 and HCFC-142b as unacceptable blowing agents as of January 1, 2010 (72 FR 14432, March 28, 2007). HFC-134a and HFC blends, particularly blends of HFC-134a, became widely used in XPS in the following decade. In the 2015 Rule, EPA changed the status of certain HFCs and HFC blends from acceptable to unacceptable in XPS as of January 1, 2021, including HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof.³⁶ Recognizing that multiple steps needed to be taken to transition to other blowing agents, including research and testing, EPA provided several years for those actions prior to the change of status date of January 1, 2021.

Based on recent submissions to EPA, EPA is aware of extensive research and testing on a number of new blowing agents for use in XPS. These newer substitutes include HFOs, hydrochlorofluoroolefins, or non-fluorinated compounds, in some cases co-blown with HFCs. In this notice of proposed rulemaking (NPRM), EPA is proposing to list as acceptable three new substitutes for use in XPS.

2. What are blends of 40 to 52 percent HFC-134a and the remainder HFO-1234ze(E); blends of 40 to 52 percent HFC-134a with 40 to 60 percent HFO-1234ze(E) and 10 to 20 percent each water and carbon dioxide; and blends with maximum of 51 percent HFC-134a, 17 to 41 percent HFC-152a, up to 20 percent CO₂ and one to 13 percent water, and how do they compare to other foam blowing agents in the same end-use?

EPA is proposing to list as acceptable (1) blends of 40 to 52 percent HFC-134a by weight and the remainder HFO-1234ze(E) for use in XPS (hereafter referred to as “HFC-134a/HFO-

³⁶ As noted above, EPA is developing a future proposed rule to respond to the court’s partial vacatur and remand of the 2015 Rule and notes that the court decision upheld EPA’s listing changes as being reasonable and not “arbitrary and capricious.”

1234ze(E) blends”); (2) blends of 40 to 52 percent HFC-134a with 40 to 60 percent HFO-1234ze(E) and 10 to 20 percent each water and CO₂ by weight for use in XPS (hereafter referred to as “CO₂/water/HFC-134a/HFO-1234ze(E) blends”); and (3) blends with maximum of 51 percent HFC-134a, 17 to 41 percent HFC-152a, up to 20 percent CO₂ and one to 13 percent water (hereafter referred to as “HFC-134a/HFC-152a/CO₂/water blends”). The components of the blends are co-blown.

HFC-134a is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2). HFC-152a, also known as 1,1, difluoroethane, has CAS Reg. No. 75-37-6. HFO-1234ze is also known as HFC-1234ze, HFO-1234ze(E) or *trans*-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9). CO₂ has CAS Reg. No. 124-38-9 and water has CAS Reg. No. 7732-18-5.

Redacted submissions and supporting documentation for these blends are provided in the docket for this proposed rule (EPA-HQ-OAR-2019-0698) at <https://www.regulations.gov>. EPA performed assessments to examine the health and environmental risks of these substitutes. These assessments are available in the docket for this proposed rule.^{37 38 39}

Environmental information: The substitutes have an ODP of zero. Their components, HFC-134a, HFC-152a, HFO-1234ze(E), CO₂, and water have GWPs of 1,430,⁴⁰ 124,⁴¹ one to six,⁴² one,⁴³ and less than one,⁴⁴ respectively. If these values are weighted by mass percentage,

³⁷ ICF, 2020j. Risk Screen on Substitutes in Extruded Polystyrene Boardstock and Billet Foam; Substitute: Blends of 40 to 52 Percent HFC-134a by Weight and the Remainder HFO-1234ze(E) (HFC-HFO Co-blowing Agents).

³⁸ ICF, 2020k. Risk Screen on Substitutes in Extruded Polystyrene Boardstock and Billet Foam; Substitute: Blends of 40 to 52 Percent HFC-134a with 40 to 60 Percent HFO-1234ze(E) and 10 to 20 Percent Each Water and CO₂ by Weight (Co-blowing Blends).

³⁹ ICF, 2020l. Risk Screen on Substitutes in Extruded Polystyrene Boardstock and Billet Foam; Substitute: Blends with Maximum of 51 Percent HFC-134a, 17 to 41 Percent HFC-152a, up to 20 Percent CO₂ and One to 13 Percent Water (Blends for Foam Blowing)

⁴⁰ IPCC (2007).

⁴¹ IPCC (2007).

⁴² Hodnebrog *et al.*, 2013 and Javadi *et al.*, 2008.

⁴³ IPCC (2007).

then the blends range in GWP from about 580 to 750.⁴⁵ HFC-134a, HFC-152a, HFO-1234ze(E), CO₂, and water—components of the blends—are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

Flammability information: The component HFC-152a is moderately flammable. The other components of the blends are non-flammable at standard temperature and pressure using the standard test method ASTM E681. However, at higher temperatures such as the temperatures typical for extruding XPS, HFC-134a, and HFO-1234ze(E) may be flammable, particularly at higher humidity levels.⁴⁶ Blends containing 50 percent or more HFC-134a have been found to have acceptable flammable process stability under conditions of use (i.e., XPS extrusion).⁴⁷

Toxicity and exposure data: Potential health effects of this substitute at lower concentrations include headache, nausea, drowsiness and dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, it may cause central nervous system depression and affect respiration. The substitute could cause asphyxiation, if air is displaced by vapors in a confined space. These health effects are common to other foam blowing agents used in this end-use.

The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-134a and

⁴⁴ Sherwood et al 2018. This paper estimated that water vapor emitted near Earth's surface due to anthropogenic sources, e.g. irrigation, would have a GWP of -10^{-3} to 5×10^{-4} . "The global warming potential of near-surface emitted water vapour," Steven C Sherwood, Vishal Dixit and Chryséis Salomez. *Environ. Res. Lett.* 13 (2018) 104006.

⁴⁵ A GWP of 580 corresponds to formulations containing approximately 40 percent HFC-134a and the remainder HFO-1234ze(E) or HFO-1234ze(E), CO₂ and water or HFC-152a, CO₂ and water; a GWP of 750 corresponds to formulations containing 52 percent HFC-134a and the remainder of HFO-1234ze(E) or HFO-1234ze(E), CO₂ and water. or 51 percent HFC-134a and the remainder HFC-152a, CO₂, and water.

⁴⁶ Bellair and Hood, 2019. Comprehensive evaluation of the flammability and ignitability of HFO-1234ze, R.J. Bellair and L. Hood, *Process Safety and Environmental Protection* 132 (2019) 273-284. Available online at doi.org/10.1016/j.psep.2019.09.033

⁴⁷ DuPont, 2019a. August 23, 2019. Letter from DuPont Performance Building Solutions to EPA.

HFC-152a and 800 ppm for HFO-1234ze(E). CO₂ has an eight hour/day, 40 hour/week permissible exposure limit (PEL) of 5000 ppm in the workplace required by OSHA and a 15-minute recommended short-term exposure limit (STEL) of 30,000 ppm established by the National Institute for Occupational Safety and Health (NIOSH). EPA anticipates that users will be able to meet the AIHA WEELs, OSHA PEL, and NIOSH STEL and address potential health risks by following requirements and recommendations in the manufacturer's SDSs and other safety precautions common to the foam blowing industry.

Comparison to other substitutes in this end-use: HFC-134a/HFO-1234ze(E) blends, CO₂/water/HFC-134a/HFO-1234ze(E) blends, and HFC-134a/HFC-152a/CO₂/water blends have ODPs of zero, comparable to all other acceptable substitutes in this end-use, such as HFC-152a, HFO-1234ze(E), methyl formate, and CO₂.

The GWPs of 580 to 750 for the HFC-134a/HFO-1234ze(E) blends, the CO₂/water/HFC-134a/HFO-1234ze(E) blends, and HFC-134a/HFC-152a/CO₂/water blends are higher than those for acceptable alternatives such as HFC-152a, HFO-1234ze(E), light saturated hydrocarbons C₃-C₆⁴⁸ and methyl formate, with respective GWPs of 124, one to six,⁴⁹ three to ten,⁵⁰ and less than five.⁵¹

Information regarding the flammability and toxicity of other available alternatives are provided in the listing decisions previously made (see <https://www.epa.gov/snap/substitutes-polystyrene-extruded-boardstock-and-billet>). Flammability and toxicity risks of the HFC-134a/HFO-1234ze(E), the CO₂/water/HFC-134a/HFO-1234ze(E) blends, and HFC-134a/HFC-

⁴⁸ That is, alkanes with three to six carbons such as butane, n-pentane, isopentane, and cyclopentane.

⁴⁹ Hodnebrog *et al.*, 2013 and Javadi *et al.*, 2008.

⁵⁰ EPA, undated. "Summary of Substitute Foam Blowing Agents Listed in SNAP Notice 25." Available online at <https://www.epa.gov/sites/production/files/2014-11/documents/notice25substitutefoams.pdf>

⁵¹ EPA, undated.

152a/CO₂/water blends are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-use. Toxicity risks can be minimized by use consistent with the AIHA WEELs, OSHA PEL, NIOSH STEL, recommendations in the manufacturer's SDSs, and other safety precautions common in the foam-blowing industry.

3. What is EPA proposing for HFC-134a blends in XPS?

EPA is proposing to list three specific blends of HFC-134a as acceptable in XPS. These blends have higher GWPs and are otherwise comparable or lower in risk than other alternatives listed as acceptable; however, EPA is taking this action because the Agency believes that other acceptable alternatives are not generally available for most needs under this end-use. Information available to the Agency at the time that the Agency finalized the 2015 Rule indicated that other substitutes listed as acceptable for this end-use, notably HFC-152a, HFO-1234ze(E), light saturated hydrocarbons C3-C6, and methyl formate, should be able to meet product requirements after further research and testing and thus would be available by January 1, 2021. Since that time, information provided in multiple SNAP submissions indicates that despite research and testing over the past several years, three of these four substitutes - HFO-1234ze(E), light saturated hydrocarbons C3-C6, and methyl formate - have not been proven to meet density and testing requirements of building codes and standards, such as for thermal efficiency, compressive strength, and flame and smoke generation, necessary for XPS products. One of the three manufacturers of XPS in the United States has had some success using neat⁵² HFC-152a as a blowing agent to manufacture some XPS products.

In order for substitutes to be available in this end-use, they must be capable of blowing foam that meets the technical needs of XPS products including density and ability to meet testing

⁵² Individual, unblended blowing agents.

requirements of building codes and standards, such as for thermal efficiency, compressive strength, and flame and smoke generation. EPA considered relevant information included in multiple SNAP submissions in the development of this proposal regarding whether foam blowing agents currently listed as acceptable can be used to produce foam that meets the performance specifications for XPS foam. The submitter of the proposed blends presented specific evidence supporting a claim that other acceptable substitutes have not yet provided sufficient performance when considering density and testing requirements. In particular, the submitter provided information developed over five years evaluating a variety of alternative blowing agents in hundreds of trials. The submitter indicated that it was having difficulty meeting requirements for insulation value (“R-value”) with neat acceptable blowing agents such as HFO-1234ze(E), HFC-152a, and CO₂.⁵³ Further, the submitter indicated that if in some cases it could meet R-value requirements with those neat blowing agents, these alternatives were not able to meet other requirements such as compressive strength, density and thickness, or fire test results. The submitter also identified challenges with meeting code requirements for XPS products manufactured with flammable substitutes (e.g., HFC-152a, light saturated hydrocarbons C3-C6, and methyl formate) and provided examples of failed test results.

Based on all of the evidence before the Agency, it now appears that only one of the substitutes that the Agency believed at the time of the 2015 Rule would be available for use in XPS foam as of January 1, 2021 is in fact available and likely could only be used to meet the needs for some portion of the XPS foams market.⁵⁴ The Agency is concerned about ensuring that the needs of the full XPS foams market in the United States can be met. In addition to a concern

⁵³ DuPont, 2019b. December 17, 2019 Letter from DuPont Performance Building Solutions to EPA.

⁵⁴ The set of products that may be able to be manufactured with HFC-152a would account for a minority of the current market for XPS.

that all of the needs of the XPS foams market cannot be met, EPA considers it important that the SNAP program not limit the choice of acceptable substitutes to only one option, where possible. For these reasons, EPA is proposing to list additional blowing agent options for XPS that have been proven to work for this end-use.

The submitter has tested the three blends with HFC-134a addressed in this proposal and has found the blends create larger cells in XPS which can be important for meeting the needed range of densities and meeting other testing requirements. Thus, by adding these two substitutes to the list of acceptable substitutes, XPS manufacturers will have at least three viable substitutes to choose from in manufacturing XPS products and these substitutes should allow manufacturers to meet additional needs for XPS foams in the United States. EPA requests comment on the proposed listing of these blends of HFC-134a as acceptable in XPS.

EPA notes that the proposed listings are summarized below. Because the Agency is not proposing to restrict or prohibit use of these substitutes in this end-use, it is not proposing regulatory text at the end of this document that, if finalized, would appear in the CFR. If EPA were to finalize these listings as proposed, the Agency would publish them in the preamble to the final rule and would add them to the list of acceptable substitutes for XPS on EPA's website at <https://www.epa.gov/snap/substitutes-polystyrene-extruded-boardstock-and-billet>.

Summary of Proposed New Listings for XPS Foam Blowing Agents

End-use	Substitute	Proposed Decision	Further Information
Extruded Polystyrene: Boardstock and Billet	Blends of 40 to 52 percent HFC-134a by weight and the remainder HFO-1234ze(E)	Acceptable*	These blends have GWPs of 580 to 750, depending on the specific composition. Blends containing 50 percent or more HFC-134a have been found to have acceptable flammable process stability under conditions of use (i.e., XPS extrusion).
Extruded Polystyrene: Boardstock and Billet	Blends of 40 to 52 percent HFC-134a with 40 to 60	Acceptable*	These blends have GWPs of 580 to 750, depending on the specific

	percent HFO-1234ze(E) and 10 to 20 percent each water and CO ₂ by weight		composition. Blends containing 50 percent or more HFC-134a have been found to have acceptable flammable process stability under conditions of use (i.e., XPS extrusion).
Extruded Polystyrene: Boardstock and Billet	Blends with maximum of 51 percent HFC-134a, 17 to 41 percent HFC-152a, up to 20 percent CO ₂ and one to 13 percent water	Acceptable*	These blends have GWPs of 580 to 750, depending on the specific composition. Blends containing 50 percent or more HFC-134a have been found to have acceptable flammable process stability under conditions of use (i.e., XPS extrusion).

*Notwithstanding the unacceptable listings in general for blends of HFC-134a in XPS, EPA is proposing these specific blends of HFC-134a to be acceptable in this end-use.

In light of the Agency's proposal to list the above-mentioned blends of HFC-134a as acceptable, EPA is proposing to revise the current unacceptable listing for blends of certain HFCs in XPS in appendix U to 40 CFR part 82, subpart G. The listing for unacceptable substitutes in XPS states that HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; and Formacel TI, Formacel B, and Formacel Z-6 are "unacceptable as of January 1, 2021, except where allowed under a narrowed use limit." EPA is proposing to revise the listing of unacceptable substitutes for XPS in appendix U to read that the substitutes are "Unacceptable as of January 1, 2021 except where allowed under a narrowed use limit or where blends are specifically listed as acceptable." EPA is not opening up for comment other aspects of this existing listing.

D. Total Flooding: Proposed removal of Powdered Aerosol E from the list of substitutes acceptable subject to use conditions

Powdered Aerosol E, also marketed under the trade names of FirePro, FirePro Xtinguish, and FireBan, is generated in an automated manufacturing process during which the chemicals, in powder form, are mixed and then supplied to end users as a solid contained within a fire extinguisher. In the presence of heat, the solid converts to an aerosol consisting mainly of

potassium salts. EPA listed Powdered Aerosol E as acceptable, subject to use conditions, as a total flooding agent (71 FR 56359, September 27, 2006). The use conditions required that Powdered Aerosol E be used only in areas that are normally unoccupied, because the Agency did not have sufficient information at that time supporting its safe use in areas that are normally occupied. Based on a review of additional information from the submitter to support the safe use of Powdered Aerosol E in normally occupied spaces, EPA subsequently determined that Powdered Aerosol E is also acceptable for use in total flooding systems for normally occupied spaces (83 FR 50026, October 4, 2018). The listing provides that Powdered Aerosol E is acceptable for total flooding uses, which includes both unoccupied and occupied spaces. In the October 2018 listing action, EPA noted that in a subsequent rulemaking, the Agency would remove the previous listing of Powdered Aerosol E as acceptable, subject to use conditions since the use condition is no longer applicable. EPA is proposing to take the ministerial action of removing that listing for Powdered Aerosol E and is requesting comment on this proposal.

III. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is not a significant regulatory action and was therefore not submitted to the Office of Management and Budget (OMB) for review.

B. Executive Order 13771: Reducing Regulations and Controlling Regulatory Costs

This action is expected to be an Executive Order 13771 deregulatory action. This proposed rule is expected to provide meaningful burden reduction because it allows for the use of additional ODS substitutes and there is no requirement to use the substitutes listed in this action.

C. Paperwork Reduction Act (PRA)

This action does not impose any new information collection burden under the PRA. OMB has previously approved the information collection activities contained in the existing regulations and has assigned OMB control number 2060-0226. The approved Information Collection Request includes five types of respondent reporting and recordkeeping activities pursuant to SNAP regulations: submission of a SNAP petition, filing a Toxic Substances Control Act (TSCA)/SNAP Addendum, notification for test marketing activity, recordkeeping for substitutes acceptable subject to use restrictions, and recordkeeping for small volume uses. This rule contains no new requirements for reporting or recordkeeping.

D. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. In making this determination, the impact of concern is any significant adverse economic impact on small entities. An agency may certify that a rule will not have a significant economic impact on a substantial number of small entities if the rule relieves regulatory burden, has no net burden or otherwise has a positive economic effect on the small entities subject to the rule. This action allows the additional options of using R-32, R-448A, R-449A, R-449B, R-452B, R-454A, R-454B, R-454C, R-457A, blends of 40 to 52 percent HFC-134a by weight and the remainder HFO-1234ze(E), blends of 40 to 52 percent HFC-134a with 44 to 58 percent HFO-1234ze(E) and one to two percent each water and CO₂ by weight, and blends with maximum of 51 percent HFC-134a, 17 to 41 percent HFC-152a, up to 20 percent CO₂ and one to 13 percent water in the specified end-uses, but does not mandate such use. Users who choose to use R-448A, R-449A, and R-449B must make a reasonable effort to ascertain that other substitutes or alternatives are not technically feasible and must document and keep records

of the results of such investigations. Because equipment for R-452B, R-454A, R-454B, R-454C, and R-457A is not manufactured yet in the U.S. for the residential and light commercial air conditioning and heat pumps end-use, no change in business practice is required to meet the use conditions, resulting in no adverse impact compared to the absence of this rule. Equipment for R-32 already being manufactured has been subject to similar use conditions, resulting in no adverse impact compared to the absence of this rule. Thus, the rule would not impose new costs on small entities if finalized as proposed. We have therefore concluded that this action will not impose a significant adverse regulatory burden for all directly regulated small entities.

E. Unfunded Mandates Reform Act (UMRA)

This action does not contain any unfunded mandate as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. The action imposes no enforceable duty on any state, local or tribal governments or the private sector.

F. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

G. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

This action does not have tribal implications as specified in Executive Order 13175. It will not have substantial direct effects on tribal governments, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes, as specified in Executive Order 13175. Thus, Executive Order 13175 does not apply to this action. EPA periodically updates tribal officials on air regulations through the monthly meetings of the National Tribal Air Association

and will share information on this rulemaking through this and other fora.

H. Executive Order 13045: Protection of Children from Environmental Health and Safety Risks

This action is not subject to Executive Order 13045 because it is not economically significant as defined in Executive Order 12866, and because EPA does not believe the environmental health or safety risks addressed by this action present a disproportionate risk to children. The EPA has not conducted a separate analysis of risks to infants and children associated with this rule. Any risks to children are not different than the risks to the general population. This action's health and risk assessments are contained in the comparisons of toxicity for the various substitutes, as well as in the risk screens for the substitutes that are proposed to be listed. The risk screens are in the docket for this rulemaking.

I. Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use

This action is not subject to Executive Order 13211, because it is not a significant regulatory action under Executive Order 12866.

J. National Technology Transfer and Advancement Act

This action involves technical standards. EPA proposes to use and incorporate by reference portions of the 2019 UL Standard 60335-2-40, which establishes requirements for the evaluation of residential air conditioning equipment and safe use of flammable refrigerants, among other things. The standard is discussed in greater detail in section II.B.4 of this preamble.

The 2019 UL Standard 60335-2-40 is available at <http://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=36463>, and may be purchased by mail at: COMM 2000, 151 Eastern Avenue, Bensenville, IL 60106; Email: orders@shopulstandards.com; Telephone: 1-888-853-3503 in the U.S. or Canada (other countries dial 1-415-352-2178); Internet address: <http://ulstandards.ul.com/> or www.comm-

2000.com. The cost of the 2019 UL Standard 60335-2-40 is \$440 for an electronic copy and \$550 for hardcopy. UL also offers a subscription service to the Standards Certification Customer Library (SCCL) that allows unlimited access to their standards and related documents. The cost of obtaining this standard is not a significant financial burden for equipment manufacturers and purchase is not required for those selling, installing, and servicing the equipment. Therefore, EPA proposes that the UL standard proposed to be incorporated by reference is reasonably available.

K. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Population

EPA believes that it is not feasible to quantify any disproportionately high and adverse human health or environmental effects from this action on minority populations, low-income populations and/or indigenous peoples, as specified in Executive Order 12898 (59 FR 7629, February 16, 1994) because for all affected populations there is no requirement to use any of the alternatives listed in this action.

IV. References

Unless specified otherwise, all documents are available electronically through the Federal Docket Management System, Docket number EPA-HQ-OAR-2019-0698.

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EPA, undated. Summary of Substitute Foam Blowing Agents Listed in SNAP Notice 25. Available online at <https://www.epa.gov/sites/production/files/2014-11/documents/notice25substitutefoams.pdf>

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ICF, 2020a. Risk Screen on Substitutes in Retail Food Refrigeration (Medium-temperature Stand-alone Units) (New Equipment); Substitute: R-448A.

ICF, 2020b. Risk Screen on Substitutes in Retail Food Refrigeration (Medium-temperature Stand-alone Units) (New Equipment); Substitute: R-449A.

ICF, 2020c. Risk Screen on Substitutes in Retail Food Refrigeration (Medium-temperature Stand-alone Units) (New Equipment); Substitute: R-449B.

ICF, 2020d. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: HFC-32.

ICF, 2020e. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: R-452B.

ICF, 2020f. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: R-454A.

ICF, 2020g. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: R-454B.

ICF, 2020h. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps (New Equipment); Substitute: R-454C.

ICF, 2020i. Risk Screen on Substitutes in Residential and Light Commercial Air-Conditioning and Heat Pumps; Substitute (New Equipment): R-457A.

- ICF, 2020j. Risk Screen on Substitutes in Extruded Polystyrene Boardstock and Billet Foam; Substitute: Blends of 40 to 52 Percent HFC-134a by Weight and the Remainder HFO-1234ze(E) (HFC-HFO Co-blowing Agents).
- ICF, 2020k. Risk Screen on Substitutes in Extruded Polystyrene Boardstock and Billet Foam; Substitute: Blends of 40 to 52 Percent HFC-134a with 40 to 60 Percent HFO-1234ze(E) and 10 to 20 Percent Each Water and CO₂ by Weight (Co-blowing Blends).
- ICF, 2020l. Risk Screen on Substitutes in Extruded Polystyrene Boardstock and Billet Foam; Substitute: Blends with Maximum of 51 Percent HFC-134a, 17 to 41 Percent HFC-152a, up to 20 Percent CO₂ and One to 13 Percent Water (Blends for Foam Blowing).
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- Shecco, 2013b. HCs Gaining Market Prominence in US—View from the NAFEM Show—Part 2, February 25, 2013.
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- Sherwood et. al. 2018. Sherwood, S. C, Vishal, D., and Salomez, C. (2018) The global warming potential of near-surface emitted water vapour. *Environ. Res. Lett.*,13 104006. Available online at <https://iopscience.iop.org/article/10.1088/1748-9326/aae018/pdf>.

UL 60335-2-40, 2019. Household And Similar Electrical Appliances - Safety - Part 2-40:
Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers.
Third Edition. November 1, 2019.

List of Subjects in 40 CFR Part 82

Environmental protection, Administrative practice and procedure, Air pollution control, Incorporation by reference, Reporting and recordkeeping requirements, Stratospheric ozone layer.

Andrew Wheeler,
Administrator.

For the reasons set forth in the preamble, EPA proposes to amend 40 CFR part 82 as follows:

PART 82—PROTECTION OF STRATOSPHERIC OZONE

1. The authority citation for part 82 continues to read as follows:

Authority: 42 U.S.C. 7414, 7601, 7671-7671q.

Subpart G—Significant New Alternatives Policy Program

2. Appendix O to subpart G of part 82 is amended by removing in the table the entry “Total flooding; Powdered Aerosol E (FirePro®)”.

3. In appendix U to subpart G of part 82:

a. Revise the appendix U to subpart G of part 82 heading.

b. Revise in the table entitled “Unacceptable Substitutes” the entry “Polystyrene: Extruded Boardstock and Billet”.

The revisions read as follows:

Appendix U to Subpart G of Part 82—Unacceptable Substitutes and Substitutes Subject to Use Restrictions Listed in the July 20, 2015 Final Rule, Effective August 19, 2015 and in the [Date of publication of the final rule in the Federal Register] Final Rule, Effective [Date 30 days after date of publication of the final rule in the Federal Register]

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Unacceptable Substitutes

End-use	Substitute	Decision	Further Information
	* * *	* *	* *

Polystyrene: Extruded Boardstock and Billet	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel B, and Formacel Z-6	Unacceptable as of January 1, 2021 except where allowed under a narrowed use limit or where a blend is specifically listed as acceptable.	These foam blowing agents have GWPs ranging from higher than 140 to approximately 1,500. Other substitutes will be available for this end-use with lower overall risk to human health and the environment by the status change date.
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4. Add appendix W to subpart G of part 82 to read as follows:

Appendix W to Subpart G of Part 82—Substitutes Listed in the [Date of publication of the final rule in the Federal Register] Final Rule—Effective [Date 30 days after date of publication of the final rule in the Federal Register]

REFRIGERANTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS

End-use	Substitute	Decision	Narrowed use limits	Further Information
Retail food refrigeration—medium-temperature stand-alone units (new only)	R-448A, R-449A, R-449B	Acceptable Subject to Narrowed Use Limits	Acceptable only for use in new medium-temperature stand-alone units where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to the inability to meet ADA requirements	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: <ul style="list-style-type: none"> • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards, ADA requirements; and/or • Anticipated date other substitutes will be available and projected time for switching.

REFRIGERANTS—SUBSTITUTES ACCEPTABLE SUBJECT TO USE CONDITIONS

End-use	Substitute	Decision	Use Conditions	Further Information
I. Residential and light commercial air conditioning and heat pumps (new only)	R-452B, R-454A, R-454B, R-454C and R-457A	Acceptable Subject to Use Conditions	<p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerants (i.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These substitutes may only be used in air conditioning equipment that meets all requirements in UL 60335-2-40.^{1 2 3} In cases where this appendix includes requirements more stringent than those of UL 60335-2-40, the appliance must meet the requirements of this appendix in place of the requirements in UL 60335-2-40.</p> <p>The charge size for the equipment must not exceed the maximum refrigerant mass determined according to UL 60335-2-40 for the room size where the air conditioner is used.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> <p>(a) On the outside of the air conditioning equipment: “WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p>	<p>Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation) and 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), and 1910.1000 (toxic and hazardous substances).</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing hydrocarbon refrigerants through adherence to good manufacturing practices as per 29 CFR 1910.106. If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability limit, the space should be evacuated and reentry should occur only after the space has been properly ventilated.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin. A class B dry powder type fire extinguisher should be kept nearby. Technicians should only use spark-proof tools when working on air</p>

			<p>(b) On the outside of the air conditioning equipment: “WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the air conditioning equipment near the compressor: “WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.”</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging: “WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations”</p> <p>(e) On the indoor unit near the nameplate:</p> <p>a. At the top of the marking: “Minimum Installation height, X m (W ft)”. This marking is only required if required by UL 60335-2-40. The terms “X” and “W” shall be replaced by the numeric height as calculated per UL 60335-2-40. Note that the formatting here is slightly different than UL 60335-2-40; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>b. Immediately below the markings described in I.(a) or at the top of the</p>	<p>conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Any refrigerant releases should be in a well-ventilated area, such as outside of a building. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with these refrigerants should obtain training and follow practices consistent with Annex HH of UL 260355-2-40, 3rd edition.</p> <p>CAA section 608(c)(2) prohibition on knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases) must be followed.</p> <p>Mildly flammable refrigerants being recovered or otherwise disposed of from residential and light commercial air conditioning appliances are</p>
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			<p>marking if (a) is not required: “Minimum room area (operating or storage), Y m² (Z ft²)”. The terms “Y” and “Z” shall be replaced by the numeric area as calculated per UL 60335-2-40. Note that the formatting here is slightly different than UL 60335-2-40; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, including portable air conditioners, window air conditioners, packaged terminal air conditioners and packaged terminal heat pumps, on the outside of the product: “WARNING—Risk of Fire or Explosion—Store in a well ventilated room without continuously operating flames or other potential ignition.”</p> <p>(g) For fixed equipment, including rooftop units and split air conditioners, “WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The equipment must have red Pantone Matching System (PMS) #185 or RAL 3020 marked pipes, hoses, or other devices</p>	likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260-270).
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			through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch (25mm) in both directions from such locations and shall be replaced if removed.	
II. Residential and light commercial air conditioning and heat pumps (new only), excluding self-contained room air conditioners	R-32	Acceptable Subject to Use Conditions	<p>This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerants (i.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These substitutes may only be used in air conditioning equipment that meets all requirements in UL 60335-2-40.^{1 2 3} In cases where this appendix includes requirements more stringent than those of UL 60335-2-40, the appliance must meet the requirements of this appendix in place of the requirements in UL 60335-2-40.</p> <p>The charge size for the equipment must not exceed the maximum refrigerant mass determined according to UL 60335-2-40 for the room size where the air conditioner is used.</p>	<p>Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation) and 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), and 1910.1000 (toxic and hazardous substances).</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing hydrocarbon refrigerants through adherence to good manufacturing practices as per 29 CFR 1910.106. If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability limit, the space should be evacuated and reentry should occur only after the space has been properly ventilated.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles</p>

			<p>The following markings must be attached at the locations provided and must be permanent:</p> <p>(a) On the outside of the air conditioning equipment: “WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) On the outside of the air conditioning equipment: “WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the air conditioning equipment near the compressor: “WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.”</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging: “WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations”</p> <p>(e) On the indoor unit near the nameplate:</p> <p>a. At the top of the marking: “Minimum Installation height, X m (W ft)”. This marking is only required if required by UL 60335-2-40. The terms “X” and “W” shall be replaced by the numeric height as</p>	<p>and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Any refrigerant releases should be in a well-ventilated area, such as outside of a building. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex HH of UL 260355-2-40, 3rd edition.</p> <p>CAA section 608(c)(2) prohibition on knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of</p>
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			<p>calculated per UL 60335-2-40. Note that the formatting here is slightly different than UL 60335-2-40; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>b. Immediately below the marking specified in II.(a) or at the top of the marking if (a) is not required: “Minimum room area (operating or storage), Y m² (Z ft²)”. The terms “Y” and “Z” shall be replaced by the numeric area as calculated per UL 60335-2-40. Note that the formatting here is slightly different than UL 60335-2-40; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>(f) For fixed equipment, including rooftop units and split air conditioners, “WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”</p> <p>(g) All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The equipment must have red Pantone Matching System (PMS) #185 or RAL 3020 marked pipes, hoses, or other devices through which the</p>	<p>maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases) must be followed.</p> <p>Mildly flammable refrigerants being recovered or otherwise disposed of from residential and light commercial air conditioning appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260-270).</p>
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			refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch (25mm) in both directions from such locations and shall be replaced if removed.	
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¹ The Director of the Federal Register approves this standard for incorporation by reference under 5 U.S.C. 552(a) and 1 CFR part 51. You may inspect a copy at U.S. EPA's Air and Radiation Docket; EPA West Building, Room 3334, 1301 Constitution Ave., N.W., Washington DC or at the National Archives and Records Administration (NARA). For questions regarding access to these standards, the telephone number of EPA's Air and Radiation Docket is 202-566-1742. For information on the availability of this material at NARA, call 202-741-6030, or go to: www.archives.gov/federal-register/cfr/ibr-locations.html.

² You may obtain this standard from: Underwriters Laboratories Inc. (UL) COMM 2000; 151 Eastern Avenue; Bensenville, IL 60106; orders@comm-2000.com; 1-888-853-3503 in the U.S. or Canada (other countries dial +1-415-352-2168); <http://ulstandards.ul.com/> or www.comm-2000.com.

³ UL 60335-2-40, Standard for Household And Similar Electrical Appliances - Safety - Part 2- 40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers, 3rd edition, Dated November 1, 2019.